Chemistry I: Atomic Structure II: Electron configuration Rules

From quantum mechanics we have a probable location of the electrons in an atom. The four quantum numbers describe an electron. The **Pauli exclusion principle** says that no two electrons can have the same exact quantum numbers. This means that they cannot be in the exact same place at the exact same time.

Now, where are they? Well we know that they are in regions called atomic orbitals. These 3-D regions of space are probable locations of electrons. Any one atomic orbital can only hold 2 electrons. We also know that the orbitals have shapes and are oriented around the X, Y, and Z-axis.

Atomic orbitals are subdivided into suborbitals. This is how it looks:

Orbital	Suborbitals	# electrons	Labels	shape
s	1	2		Sphere
p	3	6	p_x p_y p_z	Dumbbells
d	5	10	Too complex	Multiple lobes
f	7	14	Don' t go there	Multiple lobes

Aufbau principle
When electrons are added to the outside of a nucleus they will go into the orbital with the lowest energy. You cannot add outside in.

Hund's rule
Orbitals of equal energy are each occupied by one electron before any one orbital is occupied by a second electron and all electrons in a singly occupied orbital must have the same spin (must be going the same way as the others). Explanation: when putting electrons in the p-orbitals there must be one electron in p_x, p_y and p_z before any of the others can have get a second electron.

Following the flow chart:

When writing electron configuration you will need to follow the order of fill chart. This is a systematic way of arranging the electrons. You will need to know how many electrons are in each of the orbitals. The configuration you write may not match what is in Chemistry textbooks because electrons in more complex atoms will move to create more stable configurations based on the lowest possible energy.

Remember that the most stable electron configuration is that of the noble gases which all have nS^2nP^6 configuration.

Writing the electron configuration for ions.

Remember ions are atoms of an element with a charge.

The charge is due to the number of electrons compared to the number of protons.

So you will need to figure the exact number of electrons.

Examples:

The **neutral sodium** atom has **10 protons and 11 electrons**. The electron configuration for this atom would be $\mathbf{1s^2 2s^2 2p^6 3s^1}$ The **sodium ion (Na^{+1})** has **10 p^+ and 10e^-** and configuration for this ion is $\mathbf{1s^2 2s^2 2p^6}$

A neutral atom of fluorine has **9 p^+ and 9 e^-**. The configuration for this atom is $\mathbf{1s^2 2s^2 2p^5}$**.** The **fluoride ion (F^{-1})** has **9 p^+ and 10 e^-** and the configuration is $\mathbf{1s^2 2s^2 2p^6}$

Notice that **both ions** now have the **same configuration**; $\mathbf{1s^2 2s^2 2p^6}$ .This is the same configuration for the Noble gas, **neon** which is an extremely stable element and will not react with anything.